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Reconstructing Sedimentary and Structural History of Middle Jurassic–Early Cretaceous Basins of the Eastern Yanshan Belt, Northern North China

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Debates exist about tectonic evolution of the Yanshan belt from the Late Jurassic to early Early Cretaceous. We carried out a study of the Beipiao and Yangshan basins in the eastern Yanshan belt where Upper Jurassic–Early Cretaceous successions are well preserved. Based on extensive fieldwork and geochronological study, we refined ages of stratigraphic units by dating volcanic interlayers, restored filling processes by analyzing sedimentary facies and facies sequences, and constrained structural evolution of border faults by investigating their kinematics and interrelations. The Haifanggou and Lanqi Formations were formed in the Mid–Late Jurassic, whereas the Tuchengzi Formation developed from the Late Jurassic to Early Cretaceous (Valanginian). Volcanism was active throughout the late Middle Jurassic to Early Cretaceous, with the Lanqi Formation recording the peak of volcanic eruptions around 161 Ma. The Haifanggou Formation occurs only in the Beipiao basin, consisting mainly of conglomeratic beds. Mudstone–siltstone association becomes dominant in the upper part in association with abundant volcanics and volcanoclastics. The Lanqi Formation is made up of basaltic andesite and pyroclastic rocks, and appears continuous with the underlying Haifanggou volcano–clastic deposits. The Lanqi volcanics are widespread, and rest unconformably over underlying strata where the Haifanggou Formation is absent. The Tuchengzi Formation, up to 5000 m thick, makes up the bulk of clastic fills of the Yangshan basins, but less developed in the Beipiao basin. The Tuchengzi succession can be divided into three distinct parts, with the lower part composed of finer facies; the middle characterized by

massive conglomerate; and the upper featured by occurrence of aeolian sandstone. Restoration of sediment–routing systems clearly indicates that basin fills were dominantly sourced from the west. The two basins are now bounded on the west by east-directed thrust faults, which placed the upper-plate Proterozoic rocks over the strata as young as Early Cretaceous Sunjiagou Formation. The Lanqi and Tuchengzi Formations near basin-border faults are also folded, and partially involved into the upper plate in a few localities. Accordingly, the basin-border thrust faults must have taken place after the formations of Lanqi–Tuchengzi succession. It is argued that both the Beipiao and Yangshan basins were formed in an extensional setting during the Middle Jurassic to Early Cretaceous, and tectonic subsidence was originally controlled by normal faults at the basin western edges. This argument is based on following considerations: (1) Occurrence of rigorous volcanism that rarely happens in compressional basins; (2) Generation of Mid–Late Jurassic magmatism is demonstrated to have resulted from lithospheric stretching; (3) Synsedimentary normal faults are common within both the Haifanggou and Tuchengzi Formations. It is claimed that the Beipiao basin was initiated as a half graben controlled by a normal border fault on the west. The Yangshan basin, however, evolved from three independent subbasins, which were then combined together due to lateral migration and linkage of the border faults through time. Reconstruction of the basin tectono–sedimentary development indicates an extension tectonic setting in the Yanshan belt during the Late Jurassic to Early Cretaceous.

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